

Missouri Department of Natural Resources
Middle Fork Grand River - WBID 0468
Bacterial data by U.S. Geological Survey, 2000-2006

Org	Site	Site Name	Yr	Mo	Dy	Flow	FC	Ecoli	Recreation Season	
									Log FC	Log E. coli
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2000	7	12	2	2800	3	7.94	1.10
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2000	9	7	0.09	640	27	6.46	3.30
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2000	5	17	0.18	440	570	6.09	6.35
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2001	5	1	74	35000	32000	10.46	10.37
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2001	7	12	4.2	290	140	5.67	4.94
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2001	9	19	4.5	1200	1100	7.09	7.00
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2002	5	8	28	7300	6100	8.90	8.72
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2002	7	31	0.4	280	300	5.63	5.70
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2002	9	4	0.15	740	480	6.61	6.17
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2003	5	21	4.2	920	1000	6.82	6.91
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2003	7	16	0.39	160	120	5.08	4.79
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2003	9	3	0.01	1100	1000	7.00	6.91
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2004	5	19	40	60000	68000	11.00	11.13
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2004	7	8	5.7	1300	1200	7.17	7.09
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2004	9	9	3.5	560	110	6.33	4.70
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2005	5	24	12	870	770	6.77	6.65
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2005	7	7	2.6	560	420	6.33	6.04
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2005	9	15	0.71	200	140	5.30	4.94
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2006	5	24	4.6	1100	730	7.00	6.59
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2006	7	26	0.42	290	290	5.67	5.67
USGS	468/20.0	M. Fk. Grand R. nr Grant City	2006	9	7	2.5	720	800	6.58	6.68
								Log Mean	6.95	6.27
								Log Standard Deviation	1.53	2.16
								Sample Size	21	21

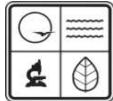
M. Fk. Grand R. is a Class A Whole Body Contact recreational water with a Fecal Coliform standard of 200 colonies/100 ml and E. coli standard of 126 colonies/100 ml. This standard is for the geometric (log) mean of all bacterial samples taken during the recreational season , April 1 to October 31. The water body is judged to be impaired if the 60 % Upper Confidence Limit (UCL) of the mean is more than the appropriate water quality standard. The formula for the 60% UCL is:

$$60\% \text{ UCL} = (\text{sample mean}) + ((0.253)(\text{standard deviation}) / (\text{square root of sample size}))$$

Bacterial data are normalized by natural log transformation and the UCL calculations for both Fecal Coliform and E. coli are shown below

Fecal Coliform 60% UCL=	(6.95) + ((0.253)(1.53)/4.58) =	7.03	Antilog of 7.03=	1130.03
E. coli 60% UCL =	(6.27) + ((0.253)(2.16)/4.36) =	6.39	Anitlog of 6.39=	595.857

Since the 60% UCL for both fecal coliform and E. coli bacteria exceed their respective standards, this stream is judged to be **impaired** by both fecal coliform and E. coli bacteria.



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Aquatic Invertebrate Monitoring by MoDNR

Org	Site	Water Body	Date	Score
MoDNR	1	M. Fk. Grand R.	Fall 1999	14
MoDNR	4	M. Fk. Grand R.	Fall 2004	20
MoDNR	3	M. Fk. Grand R.	Fall 2004	20
MoDNR	2	M. Fk. Grand R.	Fall 2004	20
MoDNR	1	M. Fk. Grand R.	Fall 2004	20
MoDNR	4	M. Fk. Grand R.	Spring 2005	16
MoDNR	3	M. Fk. Grand R.	Spring 2005	18
MoDNR	2	M. Fk. Grand R.	Spring 2005	14
MoDNR	1	M. Fk. Grand R.	Spring 2005	16

Site 4: at Hwy 46, Site 3: @Hwy YY

Site 2: at Hwy 169, Site 1: @ Hwy 136

The Missouri Department of Natural Resources collected and analyzed aquatic invertebrate samples. Staff followed the department's Environmental Services Program's written standard operating methods contained in "Semi-Quantitative M. Macroinvertebrate Stream Bioassessment" by R. Sarver, 2003. Invertebrate communities are judged to be impaired if the percent of sampling sites receiving a score of 16 or more is significantly less than for reference streams in the same ecological drainage unit. Scores of 16 or more are considered to reflect unimpaired macroinvertebrate communities.

Staff took all samples from Glide and Pool habitat. Reference streams in this ecological drainage unit sampled for glide/pool habitat scored 16 or higher on 79.5 percent of all samples. For the Middle Fork Grand River, seven of nine samples, or 77.7 percent, scored 16 or higher. For a stream that scores 16 or higher on 79.5 percent of all samples, seven scores of 16 or higher in nine samples has a binomial probability Type One error rate of 0.579. This is greater than the acceptable Type One error rate of 0.05. Thus, Middle Fork Grand River is judged to have an **unimpaired** aquatic invertebrate community.

Missouri Department of Natural Resources, Water Protection Program, www.dnr.mo.gov, (573) 751-1300

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